Lacrosse Stick

Field of the Invention

[0001] This invention relates to lacrosse sticks.

Background of the Invention

[0002] In the game of lacrosse, players use sticks to receive and shoot a ball. Lacrosse sticks generally include an elongated stem and a head portion. The player grips a handle located toward the butt end of the stem, and utilizes the head portion, which includes mesh, to receive and shoot the ball during play.

[0003] Decades ago, some lacrosse sticks were manufactured as one-piece, integral wooden structures. Such sticks were not only difficult and costly to fabricate, but owing to their unitary mechanical properties, also limited the maneuvers that a player could execute. For example, the stiff wood, while necessary for handle strength, was poorly suited to the head portion; the lack of flexibility would, for example, limit the player's ability to scoop up the ball from the ground or make it more difficult for a player to receive a hard pass without feeling excessive vibrations.

[0004] As a result, it has become commonplace to fabricate lacrosse sticks using a stem element formed of straight grained wood, or wood laminate, or a tough, lightweight metallic or reinforced plastic tubular element and to affix to the forward end of the stem a flexible head frame (composed, for example, of a tough synthetic thermoplastic material such as high impact-strength nylon). Indeed, most lacrosse sticks today are sold as separate head and stem portions.

[0005] A typical head frame for a lacrosse stick includes a socket to receive the forward end of the stem. The stem is then coupled to the head frame by a fastener, such as a screw. One problem with such a construction is that the connection between the head frame and stem may loosen during play, compromising the player's ability to effectively control his stick. Worse, in some instances the head frame may detach entirely from the stem.

Summary of the Invention

[0006] The invention provides a novel lacrosse stick having a continuous stem and head frame. The stem of the lacrosse stick is stiffer than at least a distal end of the head frame and provides a player with a superior stick for the game of lacrosse. Because of its unitary structure, the lacrosse stick of the present invention is more durable than prior art devices. Moreover, because of the differential stiffness between the stem and head frame portions, a player will be able to scoop balls from the turf more easily, receive hard passes with comfort, and generate hard shots because of the whip like action of the stick.

[0007] In one aspect of the invention, a lacrosse stick including a head portion which further includes a head frame for receiving a mesh is provided. At least a distal end of the head frame is flexible. The lacrosse stick further includes an elongated stem portion extending from a proximal end of the head frame, and the stem and head frame share at least a common continuous exterior material so as to define a unitary structure.

[0008] In one embodiment, the head frame and the stem are mechanically joined, and the stick includes a continuous sheath covering the head frame and the stem so as to define a unitary external structure. The sheath may include a polymer and/or a composite material.

[0009] In a different embodiment, the head frame and the stem are integrally continuous portions of a single mechanical structure. The head frame and stem may be integrally fabricated

by injection molding. Also, the head frame may contain a progressively reduced amount of reinforcing material. Moreover, the combination of materials injected to form the stem may provide greater rigidity than materials injected to form the head frame.

[0010] In other embodiments of the invention, the stem is formed around a tubular metal rod. The stem may be fabricated from aluminum, a light weight metal, wood, or a composite material. At least a portion of the head frame may be fabricated from a flexible plastic.

[0011] In preferred embodiments, the entire head frame has greater flexibility than at least a portion of the stem. Also, the distal end of the head frame may be angled such that an upper rim of the head frame protrudes distally of a lower rim of the head frame. The stem and the head frame may include composite materials. The composite materials may include glass, polymer, arimides, carbon, boron, or ceramics.

[0012] These and other objects, along with advantages and features of the present invention herein disclosed, will become apparent through reference to the following description, the accompanying drawings, and the claims. Furthermore, it is to be understood that the features of the various embodiments described herein are not mutually exclusive and can exist in various combinations and permutations.

Brief Description of the Drawings

[0013] In the drawings, like reference characters generally refer to the same parts throughout the different views. Also, the drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the following description, various embodiments of the present invention are described with reference to the following drawings, in which:

- FIG. 1 shows a front view of one embodiment of a continuously formed lacrosse stick and head frame in accordance with the invention;

- FIG. 2 shows a side view of the continuously formed lacrosse stick and head frame of FIG. 1;
- FIG. 3 shows a front view of another embodiment of a continuously formed lacrosse stick and head frame in accordance with the invention; and
- FIG. 4 shows a side view of the continuously formed lacrosse stick and head frame of FIG. 3.

Detailed Description

[0014] With reference to FIG. 1, a lacrosse stick 10 includes an elongate stem 14 having a proximal butt end 18 and a distal forward end 22. Extending from and integral with the distal forward end 22 of the elongate stem 14 is a head frame 26.

[0015] Coupled to the butt end 18 of the stem 14 is a handle 15 which a player grips during use of the lacrosse stick 10. A variety of handles 15 can be used in accordance with the invention. For instance, in one embodiment, the handle 15 is a hollow rubber knob that slides onto and caps the butt end 18 of the lacrosse stick 10. In another embodiment, the handle 15 is an injection-molded plastic grip with grooves designed to accommodate a player's fingers that slides onto the lacrosse stick 10. The handle 15 is not limited to those described, and can be any handle 15 that is typically used in a lacrosse stick 10 or a hockey stick.

[0016] As shown in FIGS. 1 and 2, the head frame 26 is defined by at least one wall member 30 extending distally from the distal end 22 of the stem 14 and transversely from the center line 34 of the stem 14. The distal end 23 of the wall members 30 forms a generally arcuate nose element 38, which bridges the sides that converge towards the stem 14. The wall member 30 includes an upper rim 37 and a lower rim 39. The lower rim 39 may have a plurality of apertures 43 (FIG. 2) spaced about its periphery to receive a mesh (not shown). In use, the mesh is suspended from the apertures 43 to define a bottom closure of the head frame 26. In another

embodiment, the mesh is coupled to the head frame 26 by fasteners (not shown). In general, the mesh can be coupled to the head frame 26 using any suitable means.

[0017] The upper rim 37 of the head frame 26 defines a mouth 46 in which a lacrosse ball is received into and shot from the lacrosse stick 10. The mouth 46 is generally divisible into two functional portions. The first is a throat portion 50 adjacent the juncture of the wall member 30 with the distal end 22 of the stem 14. The mesh suspended from the throat 50 of the head frame 26 defines a pocket 52, where the lacrosse ball resides during the player's retention of the ball in the lacrosse stick 10. The throat portion 50 of the head frame 26 terminates in an arcuate contour 54, the radius of curvature of the contour 54 being selected to define an accommodating surface against which the lacrosse ball rests while retained in the pocket 52. Typically, the contour 54 is lined with a soft, resilient padding which assists a player in maintaining the ball in the throat portion 50.

[0018] The mouth 46 also includes a receiving and shooting portion 58 defined by the portion of the mesh distally to the throat portion 50 and extending to the nose element 38 of the head frame 26. The receiving and shooting portion 58 is the location at which the lacrosse ball is initially received and entrapped by the player and from which the ball is ultimately passed or shot.

[0019] The nose element 38 of the head frame 26 has a generally flexible wall portion 61; for example, the wall portion 61 may be thinner than other portions of the wall member 30. The wall portion 61 is angled such that the upper rim 37 of the head frame 26 protrudes distally of the lower rim 39. The angle α of the wall 61 can range from about 10 degrees to about 80 degrees (FIG. 2). The thin, angled wall portion 61 of the nose element 38 assists a player in scooping a ball off the turf, since the flexibility of the wall portion 61 allows it to yield without excessive effort, sparing the player the need to excessively lean forward. Moreover, the wall portion 61 of

the nose element 38 facilitates the fielding of ground balls since there is less of a lip for the ball to pass over before reaching the receiving and shooting portion 58.

[0020] The stem 14 and the head frame 26 of the lacrosse stick 10 of the present invention have a unique construction that enables differential stiffness to be achieved between the stem 14 and the head frame 26. In particular, lacrosse sticks 10 according to the present invention feature a stem 14 that has greater stiffness and rigidity than at least the distal end 23 of the head frame 26, and more preferably, the stem 14 has greater stiffness than the shooting and receiving portion 58 of the head frame 26.

[0021] With continued reference to FIGS. 1 and 2, a lacrosse stick 10 that has a continuously formed stem 14 and head frame 26 is depicted where the stem 14 has greater stiffness than at least the distal end 23 of the head frame 26. In some embodiments, the stem 14 has greater rigidity than the entire head frame 26. At least the exterior of the stem 14 and head frame 26 are preferably made from composite materials, which generally consist of a thermoplastic or thermoset polymer-based resin matrix impregnated with a material, such as a fiber, to reinforce the matrix. Preferred fibers include glass, polymer arimides such as KEVLAR, carbon, boron, or ceramics. A composite may include two or more different types of fibers in a single matrix.

[0022] In one embodiment which has a unitary structure, the lacrosse stick 10 is molded (typically by injection molding) from a plastic material, for example, CAPRON polymer produced by Honeywell Plastics (Morristown, USA). To provide greater stiffness to the stem 14 than the head frame 26, the composite material used to form the stem 14 can contain a greater concentration of fiber than the material used to form the head frame 26 (which may, particularly toward the distal end 23, lack fiber altogether), or can contain a reinforcing material providing reduced stiffness. Techniques for varying the composition of a polymer during the course of molding operations are well-understood in the art. In one exemplary embodiment, the stem 14 is

formed from CAPRON polymer containing fiberglass (also provided by Honeywell Plastics) while the head frame 26 has a progressively reduced amount of reinforcing material.

[0023] In another embodiment, the lacrosse stick 10 is manufactured by co-injection molding, where materials are injected sequentially to create a core surrounded by a skin. In this embodiment, the core and skin combination in the head frame 26 is fabricated to be less rigid than the stem 14. In another embodiment, the lacrosse stick 10 is fabricated through the process of bi-injection molding, where different materials are injected through different gates. Using this technique, the combination of materials injected to form the stem 14 provide greater rigidity than the materials injected to form the head frame 26. In general, any injection molding process can be used that results in the stem 14 having greater rigidity than the head frame 26.

[0024] In still another embodiment of a continuously formed stem 14 and head frame 26, the stem 14 is formed around a metal rod or mandrel, which acts as a stiff backbone for a composite sheath, and which continues in extent to form the head frame 26. For example, KEVLAR in either unidirectional pre-preg tape, or bi-directional prepreg fabric forms may be used. In this embodiment, a plurality of composite material layers are rolled in a stacked fashion around a mandrel having the desired shape of at least the stem 14. Each of the layers may be similar, or may differ with respect to one or more of the included materials and/or properties. During the fabrication of the laminate, plies of unidirectional tape or fabric plies may be selectively oriented in the direction that provides the cured lacrosse stick 10 with the properties desired. The layers also may be of similar size and shape and stacked one on top of another, or may be of different size and shape. In addition, the stacking of the layers may be performed by using a plurality of pieces of composite material for a layer, or using only a single piece for a layer. The layers of composite materials may also be of any suitable thickness, or thicknesses. The laminate is then cured by heating, for instance in an autoclave, to form the finished product. It will be

appreciated that by varying the method of construction of the stem 14 and the head frame 26, lacrosse sticks 10 with stems 14 having greater stiffness than the head frame 26 may be fabricated.

[0025] In another embodiment, the stem 14 and the head frame 26 are mechanically joined, and a composite sheath is formed over the stem 14 and head frame 26 to define a unitary external structure as depicted in FIGS. 3 and 4. For example, the stem 14 of the lacrosse stick 10 may be fabricated from aluminum or another lightweight metal, wood, a composite material, etc. The stem 14 may also be tubular in construction throughout the longitudinal length of the stem 14 to reduce weight. The stem 14 may further have a circular, rectangular, octagonal or any other cross section desirable. The head frame 26 in this embodiment is preferably fabricated from a composite material that has a reduced stiffness is comparison to the stem 14 of the lacrosse stick 10. The stem 14 is then coupled to the head frame 26 by any suitable means. For example, the stem 14 may be attached to the head frame 26 by an adhesive bonding. Alternatively, the head portion may have a shape that facilitates attachment to the stem. For instance, as shown in FIGS. 3 and 4, the head frame 26 may terminate in a plug 60 that is received in a socket 64 formed within the distal end 68 of the stem 14, so that when so joined, the outer surface of the stem 14 is substantially flush with the outer surface 76 of the head frame 26. After the head frame 26 (which may be made, for example, from a flexible plastic such as polyethylene or copolymers of polypropylene) is attached to the stem 14, a sheath, for example, fabricated from a composite material like KEVLAR is layered onto the head frame 26 and stem 14 and cured to produce a lacrosse stick 10 with a unitary external structure. In another embodiment, a sheath covering made from a polymer, such as polyethylene, covers the head frame 26 and stem 14 portions so as to define a unitary structure.

[0026] Having described certain embodiments of the invention, it will be apparent to those of ordinary skill in the art that other embodiments incorporating the concepts disclosed herein may be used without departing from the spirit and scope of the invention. The described embodiments are to be considered in all respects as only illustrative and not restrictive.

[0027] What is claimed is: